DOCUMENT RESUME

ED 319 506 PS 018 789

AUTHOR Prawat, Richard S.
TITLE The Value of Ideas: The Immersion Approach to the Development of Thinking. Elementary Subjects Center Series No. 20.
INSTITUTION Michigan State Univ., East Lansing. Inst. for Research on Teaching.
SPONS AGENCY Office of Educational Research and Improvement (ED), Washington, DC.
REPORT NO CA-G-0098C0226
PUB DATE Apr 90
NOTE 34p.
AVAILABLE FROM Institute for Research on Teaching, College of Education, Michigan State University, 252 Erickson Hall, East Lansing, MI 48424 ($3.25).
PUB TYPE Guides - Non-Classroom Use (055)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Classroom Communication; *Cognitive Processes; Comprehension; Critical Thinking; Elementary Education; Elementary School Students; Guidelines; Research Needs; Teacher Role; Teaching Methods; *Thinking Skills
IDENTIFIERS *Constructivism; Executive Procedures (Cognition); *Immersion Approach to Thinking

ABSTRACT

In this paper, discussion covers three approaches to the fostering of higher level thinking in students: (1) the stand-alone approach, in which thinking skills are taught separately from subject matter content; (2) the embedding approach, in which thinking skills are explicitly taught in the context of subject matter content; and (3) the immersion approach, in which thinking skills remain implicit and in-depth understanding of content constitutes a necessary and sufficient condition for development of higher order thinking. Advocates of the third approach argue that it is counterproductive to devote much attention to the explicit teaching of thinking, believing that thinking develops naturally in classrooms where students are engaged in the pursuit of common understanding. The stand-alone approach is briefly discussed. The embedding approach is more extensively discussed, in terms of executive control and critical thinking skills. The immersion approach is extensively discussed in sections focusing on ideas as the central factor in the promoting of thought, examples of the approach, and the role of discourse in the approach. The concluding section of the report indicates a need for further research comparing the immersion and embedding approaches. Cited are 49 references. (RH)

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Elementary Subjects Center
Series No. 20

THE VALUE OF IDEAS: THE IMMERSION APPROACH TO THE DEVELOPMENT OF THINKING

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Published by

The Center for the Learning and Teaching of Elementary Subjects
Institute for Research on Teaching
252 Erickson Hall
Michigan State University
East Lansing, Michigan 48824-1034

April 1990

This work is sponsored in part by the Center for the Learning and Teaching of Elementary Subjects, Institute for Research on Teaching, Michigan State University. The Center for the Learning and Teaching of Elementary Subjects is funded primarily by the Office of Educational Research and Improvement, U.S. Department of Education. The opinions expressed in this publication do not necessarily reflect the position, policy, or endorsement of the Office or Department (Cooperative Agreement No. G0098C0226).

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Abstract

This paper looks at three approaches to fostering higher level thinking in students: The stand-alone approach, in which thinking skills are taught separately from subject matter content, the embedding approach, in which these skills are explicitly taught in the context of subject matter content, and the immersion approach. Advocates of this third approach argue that it is counter-productive to devote much attention to the explicit teaching of thinking, believing that it develops naturally in classrooms where students are engaged, as members of a discourse community, in the pursuit of common understanding. The immersion approach is treated in greater depth in the present paper. It represents an important alternative view within cognitive psychology because it assigns an active role to perception, thus downplaying the importance of information-processing skills in the development of thought and understanding.

THE VALUE OF IDEAS: THE IMMERSION APPROACH TO THE DEVELOPMENT OF THINKING

Richard S. Prawat[1]

Educators share a common interest in promoting higher level thinking and conceptual understanding in students. This is a timely interest as various national and international assessments point to the fact that our students lack the knowledge and reasoning skills necessary for effective functioning in the Information Age. These tests show, for example, that only a small percentage of our high school graduates are capable of complex, multistep reasoning in mathematics (Dossey, Mullis, Lindquist, & Chambers, 1988) or can function at an advanced level in reading, which involves being able to extract ideas from complex pieces of writing (Mullis & Jenkins, 1990). It is not surprising, then, that our students lag far behind those in other countries on items measuring complex thinking in all curriculum areas.

These dismal results challenge us to come up with new and better ways to promote thinking and understanding in students. In the past few years, several promising approaches have been developed. These approaches fall into three general categories. The first can be termed the "stand-alone" approach. The focus in this set of programs is on certain skills that are thought to be common to thinking in general. Presumably, these skills are best taught separately from subject matter content; while content may be included as part of the program, its mastery is clearly incidental to the main goal of improving students' ability to process information. The second approach calls for the infusing or embedding of thinking skills into the regular curriculum; this is currently the most visible of the three approaches, having been written about

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by a number of researchers (Collins, Brown, & Newman, 1989; Ennis, 1989; Perkins & Salomon, 1989). The third approach, which is a relative newcomer on the educational scene, is referred to as the "immersion" approach.

According to Ennis (1989), the major distinction between the embedding and immersion approaches is that, in the immersion approach, the principles of good thinking are not made explicit. Presumably, in this approach, in-depth understanding of content constitutes both a necessary and sufficient condition for the development of higher order thinking. Ennis (1989) has doubts about this hypothesis--specifically, as it relates to the transfer issue. If teachers do not focus explicitly on thinking, he believes, it will not transfer from one subject matter domain to another. Clearly, the assumptions about the development of thinking that underlie each of the three approaches bear further examination. This is particularly true of the immersion approach, which thus far has not been well defined (Ennis, 1989). Coming up with a definitive statement about this approach is beyond the scope of the present paper, but it would be useful to at least outline some arguments in favor of immersion as a way to promote student thought and understanding. I will do this in the context of a brief discussion about all three approaches to fostering higher order thinking.

Thinking Skills Taught Separately From Subject Matter Content: The Stand-Alone Approach

There are many arguments both for and against the stand-alone approach. On the positive side, one compelling argument is that generic thinking programs address a need that will otherwise go unmet--a need that is particularly acute in low-achieving populations. The assumption is that we all use basic cognitive process in our daily lives, like comparing, ordering, classifying, and making inferences. These processes should be important in school as well;

the trick is to figure out a way to teach them to youngsters and to get them to apply them in specific subject matter domains. One advantage of the stand-alone approach is that it doesn't penalize youngsters who lack the requisite subject matter knowledge to do well in traditional courses. Like a good training program in athletics, students are able to develop required skills independently of actually participating in the activity. The intangible effects of such "mental muscle building" (Nickerson, 1984) may be quite substantial. Brown, Bransford, Ferrara, Ferrara, & Carpione (1983) make exactly this point. Youngsters who have not experienced much success with the traditional curriculum may get an important psychological boost from programs such as instrumental enrichment developed by Feuerstein (1980).

The main argument against stand-alone programs, of course, is the oft-repeated and now generally accepted claim that generic thinking skills do not readily transfer or generalize to other parts of the curriculum, or to out-of-school performances. This gloomy assessment is based on several recent reviews (Larkin, 1989; Resnick, 1987). Apparently, the generic skills programs with the best track record for transfer are those that make a concerted effort to connect general thinking skills and specific subject matter content. This can be done by showing students how their general skills (e.g., seeing relationships in different stimuli) might be applied to particular situations, such as mathematics or science learning.

Embedding Thinking Skills in Subject Matter Content

The most viable current alternative to the stand-alone position is one that argues for infusing or embedding thinking skills into the regular curriculum--teaching thinking skills in the context of their use or application to specific subject matter. While skills are taught in the context of subject matter, they nevertheless retain their individual identity. As Beyer (1987) explains, it is

important in this approach that teachers focus on thinking as well as subject matter and not downplay the former in the interest of promoting the latter:

> Lessons that keep the focus on subject matter--history, science, the content of a short story, a particular kind of math problem--so obscure the nature of the thinking processes involved in manipulating the information that most fail to understand or learn these processes. (pp. 5-6)

The approach entails integrating subject matter and thinking skills and maintaining a roughly equal balance between the two.

It should be pointed out that advocates of the embedding approach have different views about the most appropriate starting point for teaching thinking skills. There are those who prefer a front-end strategy, arguing that it is more efficient to teach skills first and then to show students how the skills are used to achieve specific subject matter goals. Alternatively, there are those who believe that thinking skills are best taught on a need-to-know basis. There may be some motivational advantages in waiting until students encounter difficulties before offering the necessary skills; students are likely to be much more impressed with the need for acquiring the skill when this strategy is used.

Swartz (1987) provides an example of a critical thinking skill that might better be taught after students struggle a bit: that of identifying bias in conflicting accounts of the same historical event. Attending to the number of affectively loaded words in each account is likely to be seen as a more meaningful skill <u>after</u> students have wrestled with the task on their own for a while. The content-first strategy is more consistent with the immersion approach than the skills-first approach. This particular example, however, would fall in the embedding category because of the emphasis on discrete skills rather than conceptual understanding (e.g., the notion of history as interpretation).

Advocates of the embedding approach highlight two main categories of thinking skills: The first category involves broad, executive-control type skills. Although these skills are applied in different subject matter domains, there is a sameness about the processes across the various domains (Prawat, 1989). Problem analysis, planning, and decision making are key aspects of the executive-control function regardless of subject matter context; these processes, in turn, involve a diverse but important set of skills, such as defining situations, setting goals, formulating plans, comparing alternative courses of action, judging difficulty, apportioning time, and monitoring results.

Executive Control Skills

Executive-control skills are evidenced during reading when individuals can articulate their reasons for reading (e.g., for pleasure or to gain information) and when they engage in important prereading activities such as skimming the text to get a feel for its overall structure (cf., Jones, 1985). This activity, which is akin to problem analysis, may lead to the formulation of a plan about how best to allocate one's time in order to maximize learning. In mathematics, planning may take a slightly different form: It may involve outlining a solution to a problem at a very general level, adding detail as the solution proceeds (cf., Schoenfeld, 1988). In social studies, considerable emphasis is placed on comparing alternative courses of action, taking into account both personal and social factors. What these processes have in common is that they foster a reflective, deliberative approach to problem solving or decision making. Instead of jumping in, students who regulate their behavior in this way pull back to consider carefully what must be done and to devise alternative ways to approach a particular situation. This is good practice. Research in a number of domains shows that experts devote more time to problem

analysis and planning than to any other aspect of the problem solving/decision-making process.

In a widely cited recent article, Collins et al. (1989) compare three highly successful approaches to the teaching of executive-control thinking skills: the reciprocal reading strategy developed by Palincsar and Brown (1984), Schoenfeld's (1985) method for teaching mathematical problem solving, and Scardamalia and Bereiter's (1985) approach to the teaching of writing. According to Collins et al., all three programs employ a cognitive apprenticeship model of teaching. This approach is designed to bring tacit or implicit processes out into the open. Students can observe and practice them with help from the teacher and from other students. Of equal importance, according to Collins et al., is the fact that the learning is situated; that is, each of the thinking skills is taught in the context of its application to a realistic problem or concern derived from the subject matter domain. This allows students to make sense out of the activity.

In the reciprocal teaching program developed by Palincsar and Brown (1984), comprehension-monitoring skills such as summarizing and question asking are modeled and practiced in an instructional context in which participants share the goal of deriving meaning from text. The higher order thinking skills that were selected for this program were distilled from a careful review of the reading literature. Following extensive pilot work, teachers were trained in the technique for use with reading groups within the classroom. In this technique, each student in the group is taught how to function as a dialogue leader, gradually assuming responsibility for comprehension-monitoring activity such as paraphrasing main ideas, clarifying any ambiguities in a segment of text, raising possible questions about the content, and hypothesizing about the content of the next segment. This approach to reading has led to increases in

reading comprehension and it appears to transfer to other subject matter domains, in which the comprehension of text is an important higher order thinking skill.

Critical Thinking Skills

Those who advocate the embedding of thinking skills in subject matter domains focus on more than executive-control skills. They are also interested in cultivating critical thinking skills in students. These skills supposedly function more like a critic than a guide. While executive-control skills are anticipatory or proactive in nature, critical thinking skills are primarily reactive. Thinking critically involves bringing to bear certain criteria to judge the adequacy or acceptability of the intellectual products resulting from the implementation of plans generated during the executive-control phase of thinking. As Arnold (1938) put it many years ago, critical thinking is the ability "to recognize relevance, dependability, bias in sources, and adequacy of data in regard to a particular question or conclusion" (p. 257). It thus involves the ability to respond evaluatively to either one's own or someone else's interpretations or constructions of reality.

Like the executive-control skills talked about above, critical thinking skills may take on different coloration in different subject matter contexts. In social studies, for example, distinguishing between relevant and irrelevant information or scrutinizing arguments for logical consistency may be at the core of what is meant by critical thinking; in science, the focus may be on generating and testing alternative explanations for certain phenomena; in mathematics, the best way to test claims or conjectures may be to examine the premises upon which they are based. The usefulness of one or the other approach to critical thinking depends, in large part, on the type of logic that prevails within a particular disciplinary community. Mathematicians are more

enamored with deductive reasoning, while scientists prefer a type of inductive reasoning (Ennis, 1987). Social scientists, in turn, are said to rely heavily on statistical probabilities or on informal reasoning to evaluate the truth or falsity of claims; the credibility of the source of information figures prominently in this latter type of critical thinking ability (Swartz, 1987).

Those who advocate the teaching of critical thinking recognize how hard it is to define the process in the abstract. The best approach, they believe, is to try to operationalize critical thinking in the context of specific subject matter domains. Although time consuming, such an approach is well worth the effort. It is thought to be the only way to ensure that students acquire the necessary skills. They argue that it is naive to assume that students will develop these skills spontaneously in the classroom, simply by being placed in intellectually challenging situations (Beyer, 1988). It is better to get these skills out in the open, where they can be objects of both reflection and explicit instruction.

The embedding approach is a reasonable one for teachers to adopt. It is popular, in part, because it fits in nicely with much of what teachers currently do. The embedding approach does require that teachers think through what is involved in using a particular mode of thought--and that they consciously attend to these skills and dispositions in their teaching. However, advocates of this approach argue that teachers can accomplish this goal by restructuring the material they ordinarily use in their instruction (Swartz, 1987).

According to some critics, the problem with the embedding approach is <u>not</u> that thinking skills will be lost during instruction, but that they acquire an exaggerated importance. Teaching a set of specific moves can become an end in and of itself. This is illustrated in a recent study by Palincsar and her

colleagues (Palincsar, Stevens, & Gavalek, 1989). They observed that about half of the teachers who taught the reciprocal teaching strategy were unsuccessful in producing gains in reading comprehension. This was puzzling because it was obvious that their students had mastered the executive-control skills. On closer examination, however, Palincsar turned up an important difference between these teachers and those who were more successful. The successful teachers viewed the strategies as a means to an end--that of developing student understanding. The unsuccessful teachers, in comparison, regarded mastery of the technique as the goal. They thought that strategies like paraphrasing and clarifying were a good thing--in the abstract--for all students to do when they read. The strategies became just another thing for students to learn. The unsuccessful teachers failed to provide students with a sense of what the enterprise is all about.

One of the most important goals in skills training is to enhance student understanding of content. Critics of the thinking skills approach argue that this goal is best accomplished directly, by changing the nature and quality of the subject matter presented to students. A focus on thinking skills may actually divert attention away from all-important curricular issues. In other words, it may be counterproductive to concentrate on the how to aspects of thinking if we ignore what it is that we want students to think about. Lauren Resnick (cited in O'Neil, 1990) voiced a similar reservation: Perhaps, she suggested, there should be less time spent talking about thinking and more time actually doing it in the classroom. "A lot of discussion about what constitutes a rational argument, absent having one--may be exactly the wrong thing to do" (p. 3), she concludes. A concern about the prominence assigned to skills versus content gives rise to a third approach to the teaching of thinking. In this approach, thinking is an important but "implicit" part of

the curriculum Bereiter, 1989). As is obvious below, this position is just now being hammered out by researchers.

The Immersion Approach: Assigning the Highest Priority to the Content of Students' Thoughts

Because it is relatively new on the educational scene, there are still many points of disagreement among researchers about various aspects of the immersion approach. It is possible to outline the arguments in favor of such an approach, however. Perhaps I should begin with the anomaly of how something could be present but underground or invisible. As Bereiter (1989) points out, there is something paradoxical in the notion that thinking could be such an integral part of the pursuit of meaning that it might literally drop out of sight. Fortunately, there is a precedent for this sort of argument in the work being done by Csikszentmihalyi (1982). According to Csikszentmahalyi, flow is an optimal experience enjoyed by people who are in a peak-performance frame of mind: artists, athletes, or surgeons who are totally absorbed in the task at hand, for example. Flow provides a nice analogy in this case because it is a very unself-conscious type of activity. "The relationship between optimal experiences and the self is fraught with apparent paradox," Csikszentmahalyi writes. "On the one hand, the self is hidden during a flow experience; it cannot be found in consciousness. On the other hand, the self appears to thrive and grow as a result of such experiences" (p. 29).

Thinking may be a similar phenomenon; when individuals are fully engaged in trying to think through something, it may be counterproductive to have them focus too much on process, or what Parker (1989) calls the "syntax of thought" (p. 27). This is not to say that thinking, any more than flow, occurs spontaneously, in the absence of any preconditions. The preconditions for the sort of thinking envisioned by advocates of the immersion approach are

essentially two in number: Students must feel free to pursue knowledge, and they must possess the intellectual "tools" (i.e., the concepts or ideas) that allow them to do so. Establishing an environment that is conducive to learning, and ensuring that students have the intellectual resources to function within that environment, are not unique requirements. Advocates of the other two approaches would agree on these factors as well. The key difference between this third approach and the other two turns on the issue of what constitutes the most important intellectual resource or tool in promoting thought.

Ideas As the Central Factor in Promoting Thought

Advocates of the immersion approach assign a much higher priority to the role of ideas in the thinking process. In contrast, those who favor a thinking skills approach tend to equate thought with information processing. According to this latter view, thought is dependent on certain intellectual skills or abilities. These processes allow individuals to "work" knowledge, either by regulating its use, as in the case of executive-control skills, or by evaluating its adequacy or suitability, as with critical thinking skills. Absent these processes or skills, advocates of the embedding approach argue, knowledge remains inert, it just lies there. Thinking is thus synonymous with the manipulation of information--its classification, organization, storage, and retrieval.

This view hardly seems controversial. Nevertheless, as Neisser (1976) reminds us, it has not gone unchallenged. According to Neisser, there is an equally viable, alternative view within cognitive psychology that downplays the information-processing aspects of cognition in favor of a more direct approach to information pick-up and thought. There is a wide conceptual gulf between the information-processing and information pick-up (or "constructivist") views.

It is my contention that those who advocate a thinking skills approach to fostering thinking lie on the information processing side of this gulf, while those who argue for the immersion approach subscribe to the other, so-called "constructivist" orientation. While not directly addressing this issue, Neisser does lend support to the argument by highlighting some of the assumptions upon which the information-processing approach is based--an approach which he believes deserves "closer examination" (p. xii).

Early on in his book, Neisser states that psychologists may have been too quick in adopting the computer as a metaphor for mind. One problem with the computer metaphor is that it downplays the role of perception--which is thought to be a relatively passive process. Like the computer, it assumes that all of the important action occurs after the information is in the system. According to the information-processing view, everything in our environment is fully processed, although we may not be aware that this is happening; selection occurs at the stage of memory and action. Neisser (1976) contrasts this approach with constructivist theory, where perception is viewed as a much more active process. "When perception is viewed as something we do rather than as something thrust upon us," he writes, "no internal mechanisms of selection are required at all" (p. 84). Meaning, in the form of a schematic framework, influences what gets attended to. Neisser explains, "Perceivers pick up only what they have schemata for, and willy-nilly ignore the rest" (p. 80). He puts it a little more colorfully a few pages later, "To pick one apple from a tree you need not filter out all the others; you just don't pick them" (p. 85).

What does this have to do with the immersion approach to the development of thinking? Gough supplies one piece of the puzzle by explicitly linking constructivist views of perception with an idea-oriented approach to curriculum

and instruction. Citing work by Emery (1981) and others, Gough (1989) makes the following telling point,

> Educational practice since the onrush of positivist science has not valued an individual's perceptions as a source of knowledge. The meaning of perceptions is held to emerge from intellectual processes of analytic abstraction and logical inference (hence the now taken for granted separation of perception from cognition). [p. 227]

Gough wants to put perception back into education. He believes that the goal in all subjects should be to get students to attend more to important aspects of their physical, social, and cultural environment. (This last category includes works of art, literature, history, and so forth.) Gough (1989) terms this the "education of attention;" it involves "guiding learners in the many and various ways of enhancing their capabilities for extracting information from their environments" (p. 228). "Big ideas" play a key role in this regard. They provide the lens--or schemata--for understanding particular phenomena. Gough uses earth science as an example. Big ideas such as energy flow, cycles, and change, which "encapsulate" our understanding of natural ecosystems, are tools that can be used to develop an appreciation of important but everyday aspects of the students' natural environment.

It is worth emphasizing that the powerful concepts described by Gough (e.g, energy flow and change) are applied to quite specific phenomena (e.g., a fungus growing on a tree). This is the mirror image of what happens in most classrooms, where the focus tends to be on small bits of decontextualized knowledge (i.e., propositions, definitions, facts) which are then (supposedly) applied to a wide range of phenomena. Consistent with this belief, students are usually given high marks if they can recall a great deal of detailed information relevant to some global aspect of their environment (Prawat, in press). Students may learn about ideas, but they seldom are shown how to use ideas as tools to describe and explain objects and events in their natural and social

environments. According to Gough, the most effective way to get students to use ideas in this way is to expose them to teachers who model the process. He thus recommends the use of an apprenticeship system not unlike the skill-oriented approach discussed by Collins et al. (1989).

Some Examples of the Immersion Approach

Advocates of the immersion approach to thinking, I would argue, recognize the interdependence of the cognitive and the perceptual in getting students to attend to their environment. In science, as in other subject matter domains, powerful ideas function as keys to unlock important aspects of the students' environment. Roth (1989) provides an example of this in a thoughtful recent description of her "immersion" approach to the teaching of thinking in fifth-grade science:

> At the end of the unit (on photosynthesis), students revisited their initial explanations of how plants got their food and wrote and talked about how their ideas had changed. . . . Students' comments and questions revealed ways in which their conceptual understanding had generated a new sense of wonder and sense making:
>
> John: Ms. Roth, I used to think that plants were just kind of <u>there</u>, ya' know? They just sat there. But now I know that they're really very busy little things, aren't they? There's lots going on inside them.
>
> Ted: I know plants can use water, air, and sun to make food . . . but, I mean, <u>how</u> do they do that? (p. 47)

This excerpt illustrates two of the critical features of an immersion approach to the teaching of thinking. First, the focus in this excerpt is clearly on <u>ideas</u> as opposed to factual knowledge or thinking skills per se. According to the advocates of an immersion approach to thinking, ideas are more than food for thought; they are an integral part of the whole digestive process. One is tempted to draw an analogy between the process of photo-synthesis and the role of ideas in thinking. Just as plants use water, air, and sun to make food, so human beings draw on big ideas when engaged in the

thought process. In both cases, the process is a little mysterious, but there can be no doubt about what constitutes the most important condition.

Big ideas are so important to thinking that students construct their own out of whole cloth; these intuitive understandings may or may not be challenged as a result of what we do in school. In the above example, it is obvious that students did gain new insight about the role of plants in the food chain. Unfortunately, conceptual change of this sort is too often a rare occurrence in school. Witness the following quote from a college student:

> I remember having a very profound experience of suddenly really understanding, when our biology teacher asked us what the most important difference between a pig and a marigold was. And there we sat, all of us soon to be teachers with our academic qualifications, and we had no answer. The teacher had to explain: the marigold makes its own food, the pig has to steal its food! Thus, plants produce their own food and that of others mainly out of sun, air, and water. Everything fell into place. But why all those years at school learning by heart for homework and exams, when this was what it was all about? (Tronstrom cited in Marton, 1989, p. 17)

According to advocates of the immersion approach, the most important function of the educational system is to change the way people perceive the world around them. This is best accomplished by providing students with the most powerful ideas we can come up for describing and explaining things students care about (Prawat, in press). In teaching for understanding, it is the development of these ideas--as opposed to the particular line of reasoning the child might follow--that should be the central focus.

Another example might help to make this point. I will draw upon Lampert's (1987) description of a series of math lessons she conducted with her fifth-grade class. Lampert was using money as a way to represent decimal relationships. Having discussed the relative values of amounts such as $89.00, $8.90, and $.89, Lampert asked students to think about what $.089 might mean. One student offered an explanation that met with general approval from the class:

The student reasoned that $.089 was close to 9 cents, drawing on her prior knowledge that some countries had coins that were, in fact, one tenth of a cent.

At this point, Lampert decided to write .0089 on the board, inadvertently omitting the dollar sign. "I wondered if anyone would invent decimal coins of even smaller value to continue the progression," she explained. "But before I even asked what .0089 could mean, someone raised his hand and said, 'That's negative.'" Lampert made a quick decision to follow up on this line of thought. A number line was brought into play, and further discussion added more information about student thinking: Students asserted that .0089 was "definitely negative" and would fall slightly to the left of the zero on the number line (i.e., on the negative side of the number line). Between lessons, Lampert reports, she thought a great deal about what students had said. She considered a number of hypotheses about what students were thinking--all of which centered on the ideas students were expressing, not on the quality of the thought process itself (i.e., whether inductive, deductive, etc.). This was deliberate. Lampert assumes that students are being reasonable when they make seemingly erroneous claims, an assumption that she considers of utmost importance in teaching for understanding. She explains,

> The teacher saying to a student who has made an unconventional assertion: "Yes, I can see why you might think that" has the potential to communicate to the learner that he or she is a sense-making being rather than someone whose job it is to guess how to get an answer the teacher will judge to be correct (p. 36).

I will return to this example after making a point about how important the discourse process is to advocates of the immersion approach.

The Role of Discourse in the Immersion Approach

Concern about the quality of discourse in the classroom epitomizes the immersion approach (Smith & Neale, 1989). This concern is dominant whether the

individual embraces either a cognitive or a social (anthropological) perspective. In fact, there is a growing consensus among advocates of the immersion approach that these two perspectives complement one another. As Cobb (1989) points out, knowledge is both in the individual's head (the cognitive perspective) and in social interaction (the anthropological perspective). There is a dialectical relationship between these two sources of knowledge. Advocates of the immersion approach thus reject the simplistic notion that there is a sequential relationship between individual and social meaning making. As Cobb (1989) explains, "It is not just that children make their individual constructions and then check to see if they fit with those of others" (p. 34). While social interaction does allow individuals to obtain feedback on their ideas from others, the feedback process also leads to a common set of understandings on the part of group members. This, institutionalized or taken-for-granted knowledge provides an important foundation for further, individual ventures into the unknown. It also serves as a constraint on those ventures.

The institutionalized knowledge base, which is created over time in the classroom, is a resource for judging the reasonableness of individual students' subsequent interpretations of reality. Lampert (1987) illustrates how this process works. Following the lesson in which the misconception about decimal numbers emerged (i.e., that .0089 was negative), Lampert considered her next steps; "There were several ways that the next class might develop, and I needed to be prepared to cope with any of them" (p. 38). One possibility was that the issue would not even be raised; a second was that some students would bring it up and sway the rest of the class--either because they were viewed as smarter than the rest or because others had some of the same ideas. The third possibility Lampert entertained was that a mathematical argument would develop

between those who agreed with the notion that .0089 was negative and those who disagreed. Lampert continues,

> From the point of view of developing mathematical discourse, the ideal possibility would be the third. If the students who disagreed had the mathematical ammunition to convince their peers to revise their ideas, it could be said to be the pedagogical ideal as well. (In other words, what I wanted the class to learn about decimals depended on the capacity of the students who could argue that decimals were not negative to win the argument, and my commitment to mathematical discourse meant they needed to win on mathematical terms.) At this point, I believed that a productive mathematical argument of this sort was unlikely, however, because of what I knew about how much (or how little) the students in this class knew about the numbers between zero and one. What I decided to do next, therefore, was to prepare everyone for the possibility of such an argument, even though it might not come about. (p. 38)

This extended quote illustrates how students in Lampert's class come to rely on institutionalized knowledge in their mathematical discourse. As in disciplinary communities, individuals use this socially constructed knowledge to bootstrap their way toward greater knowledge. The metaphor preferred by philosophers of science is that of the captain who has to sail and repair the ship at the same time. While the worst plank is chosen and replaced, weight falls on those that are somewhat stronger; eventually, the sailor can stand on the new planks while replacing the old--realizing that the new planks are themselves starting to age (Phillips, 1985). In this model--which is consistent with our current thinking about disciplinary knowledge--there is no ultimate authority, either in experience or reason. Disciplinary knowledge, as in Lampert's classroom, is generated through a social process carried out by individuals participating in communities of discourse.

Comparing the Immersion and Embedding Approaches: The Need for Further Research

As I indicated at the outset, the immersion approach is a relative newcomer to educational theory. Advocates of this approach appear to agree on certain things, but there are many grey areas that are yet to be defined. There is

general support, for instance, for the view that ideas, as opposed to skills and processes, should be assigned the highest priority in promoting thought and understanding in the classroom. There is also general agreement that discourse plays a key role in this regard. It encourages students to reflect on their own thoughts; in relaying ideas to others, it is thought, we also relay them to ourselves. Discourse also serves as a mechanism for seeking common understanding: As Roby (1988) explains, "consensus on a large scale is not too much to hope for" (p. 173) in the give and take of focused discussion.

The degree to which discourse should be structured to conform to certain explicit norms is one of the grey areas that requires further examination in the immersion approach. Lampert (1988), for one, is quite particular about the language students use during discussion. If students want to change their minds in the midst of an exchange about a mathematical problem, for example, she teaches them to say "I want to revise my thinking," instead of "My answer was wrong." She provides the following rationale for this practice:

> When a student is in charge of revising his or her own thinking, and expected to do so publicly, the authority for determining what is valid knowledge is shifted from the teacher to the student and the community in which the revision is asserted. (p. 31)

Other advocates of the immersion approach are less prescriptive about the norms of discourse (Cobb, Yackel, & Wood, 1988). All agree, however, that the immersion approach represents a marked departure from traditional, transmission-oriented modes of instruction.

How Much Change is Required?

While advocates of the immersion approach tend to agree about the need for fundamental change in education, those who would embed thinking skills into the standard curriculum are less certain about the extent of change that is required. They appear to have a more modest agenda with regard to current

practice, assuming that higher order thinking can be fostered by adapting--as opposed to overhauling--existing curricula. Beyer (1987), for example, one of the foremost advocates of the embedding approach, argues that the techniques and strategies for fostering thinking can be used in conjunction with the approaches teachers regularly use to get across subject matter. Swartz (1987) agrees, saying that teachers need only adapt their existing material to teach for critical thinking at the K-12 level.

Advocates of the immersion approach are wary of this claim. They see a world of difference between the existing approach, which assumes that teaching and learning follows a well-tred path, and curricula developed to teach big ideas. In most classrooms, the textbook defines the curriculum; this is not likely to change with the addition of thinking skill exercises. An idea-oriented curriculum, on the other hand, does represent a marked departure from this pattern. For one, it is much looser and more flexible than the standard fixed agenda. "If one is to teach in a way that promotes conceptual understanding," Lampert (1989) writes, "there is no clear starting place or sequence of lessons that is universally appropriate" (p. 50). Teachers need to know where the teaching and learning process is headed, but not in the traditional sense of one topic following another; it is more important that they develop a global view, focusing on the network of big ideas that help define the domain of inquiry. Essence is emphasized; when this is perceived by students, the teacher then works to expand this perception (Zukav, 1984). Working from a network or map does not allow the teacher to predict what is going to happen in all situations, but it does allow the teacher to anticipate future possibilities (Elliott, 1988).

The immersion approach changes the teacher's role. The teacher is less the dispenser of information than the negotiator, or cross-country guide who works

collaboratively with students to overcome various obstacles to learning (Prawat, 1989). The discourse-centered mode of teaching places greater demands on both teachers and students. As Cohen (1988) points out, "Teachers who take this path [i.e., the conceptual approach] must work harder, concentrate more, and embrace larger pedagogical responsibilities than if they only assigned text chapters and seatwork" (p. 38). It is likely that teachers will invest this extra time and energy only if they are convinced that it will result in more productive learning on the part of students. Fortunately, there is a growing body of research to support the contention that the immersion approach leads to high levels of understanding and thoughtfulness on the part of students in subjects like mathematics (Lampert, 1986), science (Roth, Anderson, & Smith, 1986), and social studies (Newmann, 1990).

Pitting One Approach Against the Other

Few studies to date have attempted to compare the relative effectiveness of different ways of promoting higher order thinking in students. Brown and Palincsar's (1989) recent work is an exception. Their study appears to support the notion that the immersion approach has more potential for influencing student thinking than the embedding approach. It is worthwhile to explain how they arrived at this conclusion.

For some time now, Brown and Palincsar (1989) have been interested in the relationship between reciprocal teaching and other variables in the classroom, such as the quality of the curriculum material that students are exposed to or the nature of the social interaction that accompanies learning. In planning this series of studies, however, Brown and Palincsar encountered a problem: Existing textbook material, because it is so disjointed, skipping from one topic to another, does not allow one to test the effects of good curriculum on

student thinking and learning. For this reason, Brown and Palincsar decided to develop their own material for use at the upper elementary school level. Science was picked as the subject matter, and three units, dealing with the recurrent theme of interdependence in nature, were generated. This material, unlike the standard fare that had been reviewed, contained a great deal of cumulative reference, thus supporting students in their attempts to build a coherent, systematic knowledge base.

Brown and Palincsar (1989) contrasted the effects of reciprocal teaching with two new manipulations--one that was curricular in nature (i.e., providing access to conceptually coherent curriculum material), and one that sought to change the nature of the classroom social environment (i.e., the assignment of students to collaborative research teams). The outcome measure was the quality of student discourse in discussion and in various writing samples. While the curricular variable alone had a positive effect on the outcome measure when compared with reciprocal teaching, the two variables combined had the greatest positive effect on the quality of student discourse. Brown and Palincsar summarize the results in this way,

> One immediate outcome of this procedure (i.e., using the curricular material in conjunction with peer collaboration) is the development of a community of learners acquiring and sharing a common knowledge base. The nature of the reading/learning discussions and writing samples all reflect higher levels of reasoning skills than were apparent in the original reciprocal teaching dialogues. (p. 4)

They comment further,

> The original reciprocal teaching method achieved success at getting poorly performing students to strive for meaning. The simple extension of this work involved asking students to read separate texts focussed on recurrent themes (camouflage, mimicry, etc.). This led to a great increase in the use of analogy and cross reference, but having the students generate and "own" their particular knowledge--form a community of learners, responsible for each other, etc.--leads to a sea change in spontaneous activities that promote deeper understanding and a search for coherent causal explanations. (p. 5)

Brown and Palincsar strongly endorse the immersion approach. Early in their paper, for example, they talk about how thinking arises "naturally" in classrooms that are structured like theirs.

We need a great deal more research before passing judgment on the relative effectiveness of Brown and Palincsar's (1989) approach--which relies heavily on carefully crafted and conceptually coherent curriculum material--as opposed to other ways of implicitly fostering thinking, such as the discourse-centered approach preferred by Lampert (1989) and Roth (1989). This, however, is but one of a number of questions regarding the immersion approach that needs to be addressed. One of the most prominent of these questions concerns transfer: To what extent does immersion equal or exceed the embedding approach in producing transfer? At the present time few, if any, studies have addressed this issue. Despite the dearth of research, this issue deserves more attention. Transfer may be the Achilles heel of the thinking skills approach (Perkins & Salomon, 1989).

The Transfer Issue

Most researchers who favor the embedding approach subscribe to a generalization view of transfer. Such a view has a long history in psychology. It assumes that knowledge or skill, through repeated use in different contexts, gradually gets abstracted or stripped away from context. Lave (1988) calls this the "toolbox" approach to transfer; knowledge or skill is analogous to a set of tools carried from one place to another. Neither the tools nor the phenomena to which they are applied change as a result of their use. Psychologists are increasingly critical of this view, both on empirical and theoretical grounds. Unfortunately, generalization has not been terribly useful to those interested in developing better ways of teaching for transfer.

Arguing that situations are part of the meaning of concepts or skills--that knowledge is in the world and in the mind--Brown et al. (1989) call into question the whole idea behind the generalization view of transfer. Their strong argument in favor of a situated view of cognition raises an interesting possibility, one that is the mirror image of the generalization view of transfer: It may be that transfer is more a function of connectedness as opposed to de-connectedness. This argument is based upon three premises: First, the accessibility of knowledge is what transfer is all about. Second, accessibility depends upon organization; well-organized knowledge is more readily available than poorly organized knowledge. Third, there is a structural dimension to knowledge organization, perhaps best viewed as the amount of connectedness or linkage evident in the cognitive structure (i.e., the ability to relate one important idea to another) [cf., Prawat, 1989]. Knowledge that is well-organized is knowledge that is rich in relationships.

The role of situatedness or contextualization follows from these three premises: Ideas that are well-connected to other ideas, and well-grounded in the sense of being linked to the phenomena they help explain, are more likely to be an integral part of one's cognitive structure and therefore are more likely to be accessible in transfer situations. Ideas must connect with the world; this "indexical" knowledge (Brown et al. 1989) also contributes to the organizational structure. Because building connections of this sort is a particular strength of the immersion approach, it may be our best method of producing transfer. This possibility deserves serious consideration.

Concluding Comment

Much of what I have talked about in this last section of the paper--and, indeed, in earlier sections as well--is highly speculative. Nevertheless, this discussion will prove useful if it helps spark further research on the

interaction between subject matter content and thinking. As Ennis (1989) points out in his excellent paper, the question of how content and thinking variables relate to one another is one of the most controversial issues confronting educational researchers. It is hoped that the present paper, which seeks to clarify points of agreement and disagreement among advocates of the three contending perspectives, will prove useful to those who will carry this research forward.

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